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"A method and apparatus for facilitating a determination of a linear dimension of an object from an image of the object"

A17

The present invention relates to a method and apparatus for facilitating a determination of a linear dimension of an object from an image of the object, and in particular, though not limited to a linear dimension of an object from an image of the object formed by an image forming process, such as a photographic or telephotographic process.

In many instances it is desirable to be able to determine one or more dimensions of an object by measuring an image of the object formed by a photographic or telephotographic process or other imaging process, for example, it is desirable that by measuring an image in a photograph of an object one should be able to determine the dimensions of the object.

There is therefore a need for a method and apparatus for facilitating a determination of a linear dimension of an object from an image of the object formed by a photographic, telephotographic or other imaging process.

The present invention is directed towards providing such a method and apparatus.

In this specification any and all references to magnification are intended to include reference to positive and negative magnification, in other words enlargement in the size of an object in image form and reduction in the size of an object in image form.

A21

According to the invention there is provided a method for facilitating a determination of a linear dimension of an objection from image of the object formed by an image forming process, wherein the method comprises the step of computing the magnification of the image formed in an image plane of the image forming process relative to the object for facilitating the derivation of a measuring scale for subsequent reproduction along with a reproduction of the image, the magnification of the reproduced measuring scale corresponding to the magnification of the reproduced image.

In one embodiment of the invention the measuring scale is derived from the computed value of the magnification of the image.

In another embodiment of the invention the measuring scale derived from the computed value of magnification of the image is formed in the image plane along with the image.

In a further embodiment of the invention the computed value of the magnification of the image is stored. Preferably, the image is stored, and the stored computed value of the magnification of the image is stored separately from the stored image but correlated therewith.

In another embodiment of the invention the measuring scale is stored. Preferably, the measuring scale is stored separately from the stored image but correlated therewith.

Advantageously, the stored computed values of the magnification of the image and the measuring scale are stored electronically. Ideally, the stored computed values of the magnification of the image and the measuring scale are stored in digital format.

In one embodiment of the invention the magnification of the image is computed as a function of the distance of the image plane from the optical centre of a lens which forms the image of the object, and the focal length of the lens.

In another embodiment of the invention the method further comprises the step of determining the distance of the image plane from an optical centre of the lens which forms the image of the object.

In a still further embodiment of the invention the method further comprises the step of determining the focal length of the lens.

In one embodiment of the invention the magnification of the image is computed under the R.P. Convention by dividing the distance of the image plane from the optical centre of the lens by the focal length of the lens and subtracting the value one from the quotient of the division.

Alternatively, the magnification of the image is computed under the N.C. Convention by dividing the distance of the image plane from the optical centre of the lens by the focal length of the lens and subtracting the quotient of the division from the value one.

In one embodiment of the invention the distance of the image plane from the optical centre of the lens, and the focal length of the lens are determined by electronic computing. Alternatively, the distance of the image plane from the optical centre of the lens and the focal length of the lens are determined mechanically.

Preferably, the computation of the magnification of the image relative to the object is carried out by electronic computing.

In one embodiment of the invention the measuring scale is adapted to be formed in the image plane in a desired location relative to the image of the object.

In another embodiment of the invention the measuring scale is adapted to be moveable in the image plane relative to the image.

In a further embodiment of the invention the measuring scale is formed adjacent at least one edge of an area of the image plane within which the image is formed. Advantageously, a pair of measuring scales are formed adjacent a pair of adjacent edges of the area of the image plane within which the image is formed.

In a further embodiment of the invention the measuring scale is formed around the periphery of the area of the image plane within which the image is formed.

In a still further embodiment of the invention the measuring scale is formed adjacent the image.

In one embodiment of the invention the measuring scale is formed by a plurality of spaced apart graduations. Preferably, the graduations of the measuring scale are equi-spaced apart.

Alternatively, the measuring scale is provided by a circle, the diameter of which corresponds to one or more measuring units. Preferably, the type and number of measuring units to which the diameter of the circle corresponds are displayed along with the circle. Advantageously, the type and number of measuring units to which the diameter of the circle corresponds are displayed within the circle. Preferably, the circle is bisected by a line corresponding to a diameter of the circle. Advantageously, the diameter line extends horizontally.

In one embodiment of the invention the measuring scale corresponds to the metric measuring system. Alternatively, the measuring scale corresponds to the British Imperial System.

In one embodiment of the invention the image and the measuring scale is formed on a receiving means in the image plane. Preferably, the receiving means comprises a photosensitive medium.

In another embodiment of the invention the receiving means comprises a charge coupled device.

In another embodiment of the invention the measuring scale is formed by a light projecting means.

In a further embodiment of the invention the measuring scale is formed by a light masking means.

In a further embodiment of the invention the measuring scale is formed by an electronic forming means. Alternatively, the measuring scale is formed by a mechanical forming means.

In a further embodiment of the invention the measuring scale is converted to electronic signals, and preferably, in this embodiment of the invention the image is converted to electronic signals. Preferably, the electronic signals are analogue signals, and advantageously, the electronic signals are digital signals.

In one embodiment of the invention the image forming process is a photographic image forming process.

In another embodiment of the invention the image forming process is a telephotographic image forming process.

In a still further embodiment of the invention the image forming process is a video forming process.

Additionally, the invention provides apparatus for facilitating a determination of a linear dimension of an object from an image of the object formed by an image forming process wherein the apparatus comprises a computing means for computing the magnification of the image formed in an image plane of the image forming process relative to the object for facilitating the derivation of a measuring scale for subsequent reproduction along with a reproduction of the image, the magnification of the measuring scale corresponding to the magnification of the reproduced image.

In one embodiment of the invention a means is provided for deriving the measuring scale from the computed value of the magnification of the image.

In another embodiment of the invention a means for forming the measuring scale along with the image is provided.

In one embodiment of the invention a magnification storing means is provided for storing the computed value of the magnification of the image.

In another embodiment of the invention a measuring scale storing means is provided for storing the measuring scale.

In a further embodiment of the invention an image storing means is provided for storing the image.

Preferably, the magnification storing means and the measuring scale storing means are separate from the image storing means but correlated with the image storing means.

In one embodiment of the invention a means for determining the distance of the image plane from the optical centre of a lens which forms the image of the object is provided. Preferably, a means for determining the focal length of the lens is provided.

In one embodiment of the invention the computing means computes the magnification of the image from signals received from the means for determining the distance of the image plane from the optical centre of the lens and from signals received from the means for determining the focal length of the lens.

Preferably, the means for determining the distance of the image plane from the optical centre of the lens comprises a first sensing means for sensing the position of the lens relative to the image plane. Advantageously, the first sensing means is an electronic sensing means. Alternatively, the first sensing means is a mechanical sensing means.

In another embodiment of the invention the first sensing means comprises a combination of an electronic and a mechanical sensing means.

In one embodiment of the invention the means for determining the focal length of the lens comprises an input means for facilitating inputting of the focal length of the lens. Preferably, the input means comprises a manual inputting means.

In another embodiment of the invention the means for determining the focal length of the lens comprises a second sensing means for sensing the focal length of the lens. Preferably, the second sensing means is an electronic sensing means. Alternatively, the second sensing means is a mechanical sensing means.

In another embodiment of the invention the second sensing means comprises a reading means for reading a code on the lens indicating the focal length of the lens.

In another embodiment of the invention a focal length storing means is provided for storing the focal length of the lens.

In a further embodiment of the invention the means for forming the measuring scale is adapted for forming the measuring scale in the image plane at a desired location relative to the image.

In one embodiment of the invention the means for forming the measuring scale is adapted for facilitating movement of the measuring scale in the image plane relative to the image.

In another embodiment of the invention the means for forming the measuring scale forms the measuring scale adjacent one edge of an area of the image plane within which the image is formed.

In a further embodiment of the invention the means for forming the measuring scale forms the measuring scale adjacent two adjacent edges of the area of the image plane within which the image is formed.

In one embodiment of the invention the means for forming the measuring scale forms the measuring scale as a plurality of spaced apart graduations. Preferably, the graduations of the measuring scale are equi-spaced apart.

Alternatively, the means for forming the measuring scale forms the measuring scale in the form of a circle, the diameter of which corresponds to one or more measuring units. Preferably, the means for forming the measuring scale displays the type and number of measuring units to which the diameter of the circle correspond.

Advantageously, the type and number of measuring units to which the diameter of the circle corresponds is displayed within the circle. Advantageously, the means for forming the measuring scale forms a line corresponding to a diameter through the circle. Preferably, the line corresponding to the diameter of the circle extends horizontally across the circle.

In one embodiment of the invention the measuring scale corresponds to the metric measuring system. Advantageously, the measuring scale corresponds to the British Imperial Measuring System.

In one embodiment of the invention a receiving means is located in the image plane for receiving the image. Preferably, the receiving means comprises a photosensitive medium. Additionally or alternatively, the receiving means comprises a charge coupled device.

In one embodiment of the invention the receiving means comprises a light sensitive photographic medium.

In another embodiment of the invention the means for forming the measuring scale is adapted for forming the measuring scale on the receiving means.

In a further embodiment of the invention the means for forming the measuring scale comprises a light projecting means for projecting light onto the receiving means for

forming the measuring scale thereon. Additionally or alternatively, the means for forming the measuring scale comprises a light masking means.

In another embodiment of the invention the means for forming the measuring scale comprises an electronic forming means for electronically forming the measuring scale.

In a still further embodiment of the invention the means for forming the measuring scale comprises a printing means for printing the measuring scale on the receiving means.

Preferably, the magnification storing means, the image storing means and the measuring scale storing means are provided by electronic storing means. Advantageously, the magnification value of the image is stored in a digital format in the magnification storing means. Preferably, the measuring scale is stored in a digital format in the measuring scale storing means.

In one embodiment of the invention the apparatus is adapted for use in a photographic camera.

In another embodiment of the invention the apparatus is adapted for use is a telephotographic camera.

In a further embodiment of the invention the apparatus is adapted for use in a video camera.

In a still further embodiment of the invention the apparatus is adapted for use in a digital camera.

In a still further embodiment of the invention the apparatus is adapted for incorporation into a photographic camera.

In a still further embodiment of the invention the apparatus is adapted for incorporation into a telephotographic camera.

In another embodiment of the invention the apparatus is adapted for incorporation into a video camera.

In a further embodiment of the invention the apparatus is adapted for incorporation into a digital camera.

Further the invention provides a camera comprising the apparatus according to the invention.

In one embodiment of the invention the camera is a photographic camera.

In another embodiment of the invention the camera is a telephotographic camera.

In a further embodiment of the invention the camera is a video camera.

In a still further embodiment of the invention the camera is a digital camera.

The advantages of the invention are many. By virtue of the fact that a measuring scale is formed or provision is made for the subsequent formation of a measuring scale which can be subsequently reproduced with the image, and the fact that the measuring scale corresponds in magnification to the magnification of the image or any other subsequent reproduction of the image relative to the object, the linear dimensions of the image in the plane in which the image is formed can readily easily be determined by reference to the measuring scale, and the dimensions read from the measuring scale are the actual dimensions of the object. By forming the measuring scale to correspond with the magnification of the image as the image is reproduced to different scales, the scale will correspondingly vary to match the varying magnification of the image.

By projecting the measuring scale of a magnification corresponding to the magnification of the image onto the receiving means, such as a photosensitive medium, for example, a photosensitive photographic film, the film may be developed into a transparency or a photograph, and irrespective of the size to which the photograph is printed the magnification of the measuring scale will always correspond to the magnification of the image formed in the photograph. In other words, as the photograph is enlarged, thereby enlarging the image, the scale is proportionally enlarged, and vice versa. Furthermore, where the photographic film is developed onto a transparency, and the image on the transparency is projected onto a screen, as the projected image on the screen is enlarged or reduced, the measuring scale is proportionally enlarged or reduced. Accordingly, the actual linear dimensions of the object in the plane of the image can readily easily be read or ascertained from the measuring scale.

A further advantage of the invention is achieved when the image is stored electronically, as for example in the case of a telephotographic camera, such as a digital camera, video camera or the like, and when the magnification or measuring scale are similarly stored, since once the stored image of the object and its magnification or the measuring scale are correlated, as the image is reproduced on a larger or smaller scale, the magnification, and in turn the measuring scale will be automatically changed to correspond with the magnification of the image, and thus, by displaying the measuring scale along with the telephotographic image of the object the linear dimensions of the object in the plane of the image can readily easily be read from the measuring scale, and the dimensions read from the measuring scale are the actual dimensions of the object. The method and apparatus according to the invention are particularly advantageous where one wishes to determine the linear dimensions of a microscopic particle or organism an image of which can be recorded by an image forming process.

437

The invention will be more clearly understood from the following description of some preferred embodiments thereof which are given by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a schematic representation of a camera according to the invention incorporating apparatus also according to the invention for forming a measuring scale on a photosensitive medium,

Fig. 2 is a block representation of the apparatus for forming the measuring scale of Fig. 1,

Fig. 3 is a plan view of a photographic film of the camera of Fig. 1,

Fig. 4 is a plan view of a photograph reproduced from the photographic film of Fig. 3,

Fig. 5 is a plan view of an alternative photograph reproduced from a film of the camera of Fig. 1,

Fig. 6 are alternative representations of scales which may be used in connection with the photograph of Fig. 5, and indeed in connection with the photograph of Fig. 4, and

Fig. 7 is a view similar to Fig. 1 of a digital camera also according to the invention.

A47

Referring to the drawings and initially to Figs. 1 to 4 there is illustrated a photographic camera according to the invention indicated generally by the reference numeral 1. The camera 1 is of the type which forms an image 2 of an object (not shown) on a receiving means, namely, a photosensitive photographic film 3 in an image forming plane 4 in the camera 1. The film 3 is subsequently removed from the camera 1 and developed to form the image 2. A photograph 7 may be reproduced from the film 3 and/or a transparency for facilitating projection of an image of the transparency onto a screen. In Fig. 3 the photograph 7 is illustrated and as can be seen is an enlarged version of the film 3. The print of the image which is indicated by the reference numeral 8 in the photograph 7 is correspondingly magnified, in other words, enlarged relative to the image 2 on the film 3.

The camera 1 incorporates apparatus also according to the invention indicated generally by the reference numeral 10 for forming a measuring scale 12 along with the image 2 on the film 3 so that on printing the image of the film 3 onto the photograph 7 a print of a measuring scale 14 which corresponds to the measuring scale 12 on the film 3 is reproduced. The measuring scales 12 and 14 are metric scales and the magnification of the measuring scales 12 and 14 correspond to the magnification of the images 2 and 8, respectively, relative to the object (not shown), so that the linear dimensions of the images 2 and 8 in the plane of the film 3 and photograph 7, respectively, can readily easily be measured from the measuring scales 12 and 14, respectively, and these linear dimensions of the image are the actual dimensions of the object (not shown).

In this embodiment of the invention the measuring scale 12 formed on the film 3 comprises a plurality of graduations 15 which are equi-spaced along two peripheral edges 17 and 18 of the film 3. The graduations 15 are equi-spaced and correspond to units or a predetermined number of units of the metric system, depending on the magnification of the image 2, whether the magnification is positive or negative or zero. However, the spacing between the graduations 15 correspond to the spacing between the appropriate units or number of units on a metric scale magnified to the same level of magnification of the image 2 relative to the object. For example, if the image 2 has been positively magnified, in other words enlarged relative to the object by a factor of 5 and the spacing between adjacent graduations 15 of the measuring scale 12 is to corresponded to 1mm of the object, then the actual spacing between each graduation of the measuring scale 12 on the film 3 would be 5mm. Intermediate graduations could be included between the graduations 15. Similarly, if the image 2 had been negatively magnified, in other words reduced relative to the object and, for example, was reduced by a factor of 5, and the spacing between adjacent graduations 15 of the measuring scale 12 is to correspond to 1cm of the object, then the actual spacing between the graduations 15 on the measuring scale 12 would be $^1/_5$cm. Accordingly, as photographs 7 are produced from the film 3, as the image 2 in the photograph 7 is enlarged or reduced, the measuring scale 14 on the photograph 7 is correspondingly enlarged or reduced. Thus, irrespective of the state of

enlargement or reduction of the photograph relative to the film, and in turn the positive or negative magnification of the image relative to the object, by reading the linear dimensions of the image 8 in the plane of the photograph 7 the corresponding linear dimensions of the object are provided.

Turning now to the camera 1 and the apparatus 2, the camera 1 comprises a housing 20. A lens 21 which forms the image 2 of the object (not shown) in the image plane 4 on the film 3 is moveably mounted in the housing 20 for altering the distance between an optical centre 24 of the lens 21 and the image plane 4. In this embodiment of the invention the focal length of the lens 21 is fixed, although, the housing 20 is adapted for receiving lenses of different focal lengths and/or combinations of lenses with variable/adjustable focal lengths. A drive means, namely, a drive motor 25 is located within the housing 20 for driving the lens 21 in the directions of the arrows A and B for varying the distance between the optical centre 24 of the lens 21 and the image plane 4. A microprocessor 26 also located in the housing 20 controls the operation of the camera 1 and the drive motor 25 for focusing the image 2 of the object (not shown) in the image plane 4. An automatic focusing device 27 which will be well known to those skilled in the art is also located in the housing 20 for detecting the location of the object. The microprocessor 26 in response to signals received from the auto-focusing device 27 operates the drive motor 25 for moving the lens 21 for in turn focusing the image 2 of the object (not shown) in the image plane 4.

In this embodiment of the invention the apparatus 10 shares the microprocessor 26 with the camera 1, although, it will be appreciated that the apparatus 10 may be provided with a separate microprocessor, which would communicate with the microprocessor controlling the camera 1. This would particularly be the case in the event of the apparatus 10 being retro-fitted to the camera 1.

A means for determining the distance between the optical centre 24 of the lens 21 and the image plane 4 comprises a first sensor 30 which senses the position of the lens 21, and in turn its optical centre 24 relative to the image plane 4. A means for determining the focal length of the lens 21 comprises a second sensor 32 which

senses the type of lens 21 fitted into the camera 1, and thus the focal length of the lens 21 can be determined by the microprocessor 26 from a look-up table stored in the microprocessor 26. The second sensor 32 is provided with a reading means for reading a code on the lens which identifies the lens type. The microprocessor 26 is programmed using suitable code for computing from the signals received from the first sensor 30 the distance between the optical centre 24 of the lens 21 and the image plane 4, and is also programmed using suitable code for computing the magnification of the image 2 of the object formed in the image plane 4 on the film 3 relative to the object.

In this embodiment of the invention the magnification of the image 2 relative to the object is derived in accordance with the R.P. Convention from the formula:

$$M = V/F - 1$$

where M = magnification,

V = distance of the optical centre 24 of the lens 21 from the image plane 4, and

F = focal length of the lens 21.

Alternatively, the magnification of the image 2 formed in the image plane 4 on the film 3 relative to the object (not shown) may be derived from the following formula using the N.C. Convention:

$$M = 1 - V/F$$

where V = distance of the optical centre 24 of the lens 21 from the image plane 4, and

F = focal length of the lens 21.

A means for deriving the measuring scale 12 to be projected onto the film 3 in the image plane 4 comprises suitable code in the microprocessor 26 which computes the measuring scale 12 from the computed value of the magnification of the image. A means for forming the measuring scale 12 on the film 3 comprises a light projecting means, namely, a light projector 35 which under the control of the microprocessor 26 projects short lines of light onto the film 3 in the image plane 4 for forming the graduations 15 of the measuring scale 12 adjacent the peripheral edges

17 and 18 of the film 3. The short lines of light are projected for forming the graduations 15 of the measuring scale 12 spaced apart the appropriate distance from each other corresponding to the number of metric units between the graduations 15 and the magnification of the image 2 relative to the object (not shown). Such light projectors as the light projector 35 will be well known to those skilled in the art, and are typically of the type used for printing a date or time onto a film in a camera.

Accordingly, when the film 3 is developed, and the image of the film is subsequently printed onto photographic paper or onto a transparency the image 2 is formed as a printed image 8 on the photograph 7, and the measuring scale 12 is printed as the measuring scale 14 on photograph 7. As discussed above as the image of the film 3 is enlarged or reduced, as the case may be in a printing process onto a photographic paper or onto a transparency the image 8 and the measuring scale 14 are correspondingly enlarged or reduced as the case may be.

Referring now to Figs. 5 and 6 there is illustrated a film 40 of an image 41 of an object (not shown) which has been formed in a camera (not shown) also according to the invention. The camera according to this embodiment of the invention is identical to the camera 1 with the exception that the light projector 35 instead of projecting a scale of graduations as in the case of the camera 1 of the Figs. 1 to 4, projects a measuring scale in the form of a diameter 42 of a circle 43. The diameter 42 of the circle 43 represents a number of units in the metric system corresponding to the magnification of the image 41 relative to the object (not shown). In this embodiment of the invention the length of the diameter 42 represents 10cm, and the number of units, namely, the numeral "10" is displayed within the circle 43 above the diameter 42 and the type of units, namely, "cms" is displayed beneath the diameter 42 within the circle 43. The type and number of units which is represented by the diameter 42 of the circle 43 is relayed by the microprocessor to the light projector 35 for projecting along with the circle 43 and diameter 42 onto the film 3 in the image plane 4. In this embodiment of the invention the circle 43 is located towards the lower right hand corner of the film 3, although, it will be readily appreciated that the

circle 43 may be located in any desired position on the film by appropriately directing the light projector 35 onto the film 3 in the image plane 4.

Referring now in particular to Fig. 5 alternative arrangements of measuring scales according to the invention provided by circles 43 as well as the type and number of units represented by the length of the diameter of the circles 43 are illustrated.

Referring now to Fig. 7 there is illustrated a camera, in this embodiment of the invention a telephotographic camera, namely, a digital camera also according to the invention and indicated generally by the reference numeral 50. The digital camera 50 incorporates apparatus also according to the invention indicated generally by the reference numeral 51 for deriving and storing a measuring scale of an image formed by the camera 50. Although a digital camera 50, the main components of the camera 50 are substantially similar to those of the camera 1, as are the main components of the apparatus 51 substantially similar to those of the apparatus 10, and similar components are identified by the same reference numerals. In this embodiment of the invention the camera 50 comprises a housing 20, a lens 21 located in the housing 20 and moveably mounted relative to the housing 20 for varying the distance between the optical centre 24 of the lens 21 and the image plane 4 of the camera 20. Instead of a film 3 a photosensitive medium, namely, a charge coupled device 52 is located in the image plane 4 for receiving the image. Light through the lens 21 before being focused on the charge coupled device 52 is split by defraction through a prism (not shown) or other suitable splitting means into the primary colours of red, green and blue, which are then directed onto the charge coupled device 52. Analogue signals of the image of the object formed on the charge coupled device 52 are relayed to an analogue-to-digital converter 54, and in turn the digital signals of the image from the analogue-to-digital converter 54 are read by the microprocessor 26 for encoding for forming a digital representation of the image. The digital image is in turn stored by the microprocessor 26 in a suitable image storing means, which typically is a memory card or disc 56.

The auto-focusing device 27 in conjunction with the microprocessor 26 and the drive motor 25 moves the lens 21 relative to the image plane 4 for focusing the image of

the object on the charge coupled device 52 in the image plane 4 as already described with reference to Fig. 1. The distance between the optical centre 24 of the lens 21 and the image plane 4 and the focal length of the lens 21 are determined by the microprocessor 26 from signals received from the first and second sensors 30 and 32, respectively, as already described with reference to the camera 1 and the apparatus 10 of Figs. 1 to 4. The microprocessor 26 similarly determines the magnification of the image formed in the image plane 4 on the charge coupled device 52 and in turn derives a measuring scale as already described.

The measuring scale is stored in a measuring scale storing means, which is also provided by the memory card or disc 56, and preferably is stored in a location on the memory card or disc 56 separate from the location at which the image is stored on the memory card or disc 56. If desired the magnification of the image may also be stored in a magnification storing means, which is also provided by the memory card or disc 56, and preferably, is stored in a location on the memory card or disc 56 separate from the stored image and the stored measuring scale.

Accordingly, when an image is being reproduced from the memory card or disc 56 the measuring scale can be separately retrieved from the memory card or disc 56 and moved to any desired location relative to the image, and indeed, the orientation of the measuring scale may also be varied relative to the image for facilitating direct measuring of the image by placing the measuring scale across the image between the points of the image, across which the linear distance is to be determined. The measuring scale and image will be stored so that as the image is enlarged on reproduction the measuring scale is correspondingly enlarged and reproduced. While it is not essential, the storing of the magnification value of the image would facilitate enlargement or reduction of the measuring scale to correspond with enlargement or reduction of the image.

While the components of the digital camera 50 for forming the digital image on the memory card or disc 56 have not been described in detail, digital cameras, and the formation of a digital image will be well known to those skilled in the art.

A further advantage of storing the image and the measuring scale and/or the magnification of the image separately from each other is that the image if desired could be displayed without the measuring scale. Furthermore, separate storage would also facilitate independent operation of the measuring scale, for example, movement of the measuring scale would be facilitated so that the measuring scale could be moved to any part of the image for determining the dimensions between any two points on the image, which in turn would give the actual distance of the two points on the object of which the image is formed. It is also envisaged that a menu of different types of measuring scale could be provided and one could select a specific type of measuring scale. Accordingly, by separately storing the image and the magnification of the image a selected measuring scale could then be prepared electronically from the value of magnification of the image. Thus, by separately storing the image and the measuring scale and/or the magnification the image and type of measuring scale and its position could be determined when a print is being made of the image, or when the image is being viewed. As discussed above the measuring scale could be moved relative to the image during viewing.

Additionally, in a digital or video camera the measuring scale could be selected and programmed to appear during specific frames only, and in cases where the magnification of the image remains constant throughout a sequence of frames, recalculation of the magnification and/or the measuring scale would be avoided.

While two methods for determining the magnification of the image have been described, it is also envisaged that the magnification may be computed by the microprocessor using the following formula:

$$M = V/U$$

where M = magnification,

V = distance from the optical centre 24 of the lens 21 from the image plane 4, and

U = distance of the object from the optical centre 24 of the lens 21.

In determining the magnification using this formula, the value of "U" would be determined by the microprocessor 26 of the apparatus 10 and 51 from signals received from the auto-focusing device 27.

While various types of measuring scales have been described, it will be readily apparent to those skilled in the art that any other suitable measuring scales may be provided. It will also of course be appreciated that the measuring scales may be formed in any other suitable location on the film, for example, it is envisaged that the measuring scales may be provided on X and Y axis which would bisect the film vertically and horizontally.

While the apparatus according to the invention has been described for use in a photographic camera and in a digital camera, it will be readily apparent to those skilled in the art that the apparatus according to the invention could be used in any other type of photographic or telephotographic camera, for example, in a video camera, a video camcorder, or in any other such image forming device, apparatus or process.